ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Topo-surveying an Alpine basin using UAS

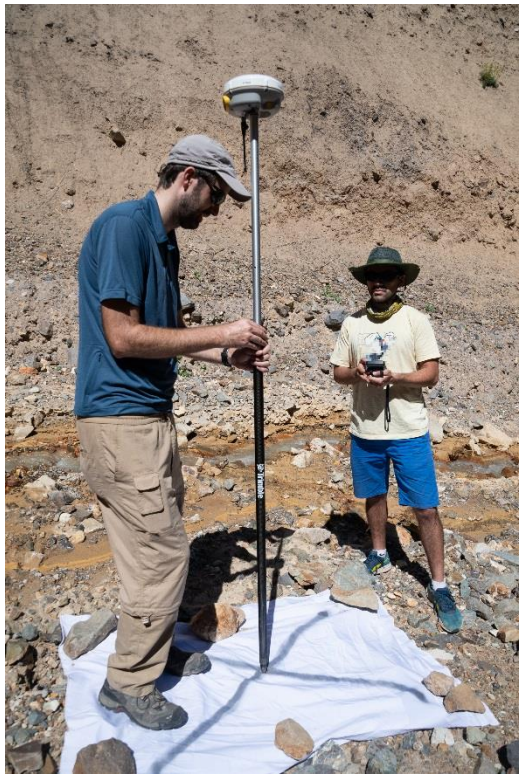
Environmental Hydraulics Laboratory

CODEV project

June 2018

CODEV project

November 2018



Main issues

- Field Investigation on Floods and Dambreak Hazards

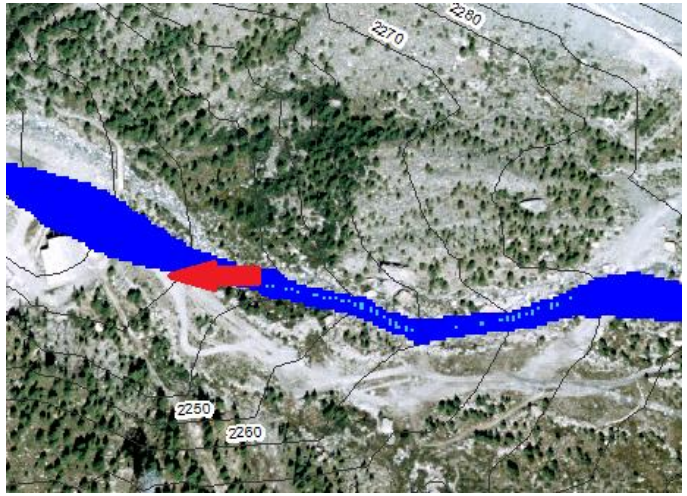
Topography data for simulation → Swisstopo DEM 3D accuracy ± 5 m → We need to get data using a drone

- Field Monitoring over Time

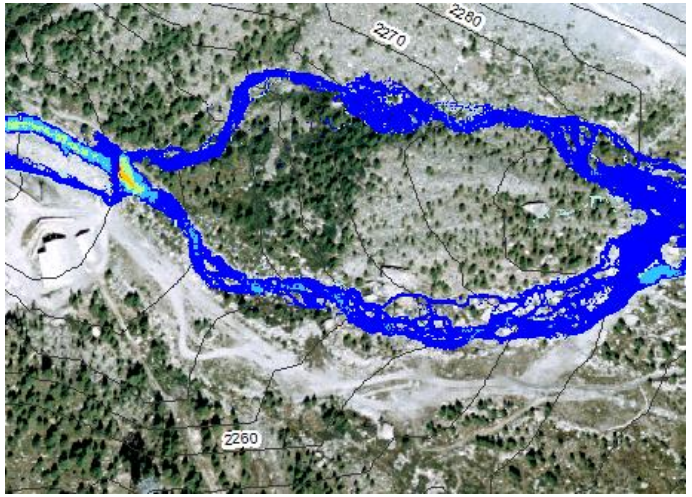
Fixed camera Timelapse → Area of interest too big → We need to get data using a drone

Flood hazard for the Gant ski lift (Zermatt, VS)

Karine Sarrasin Master project, november 2015
in collaboration with Geoformer (formerly wasser/schnee/lawinen Ingenieurbüro André Burkard AG), Brig



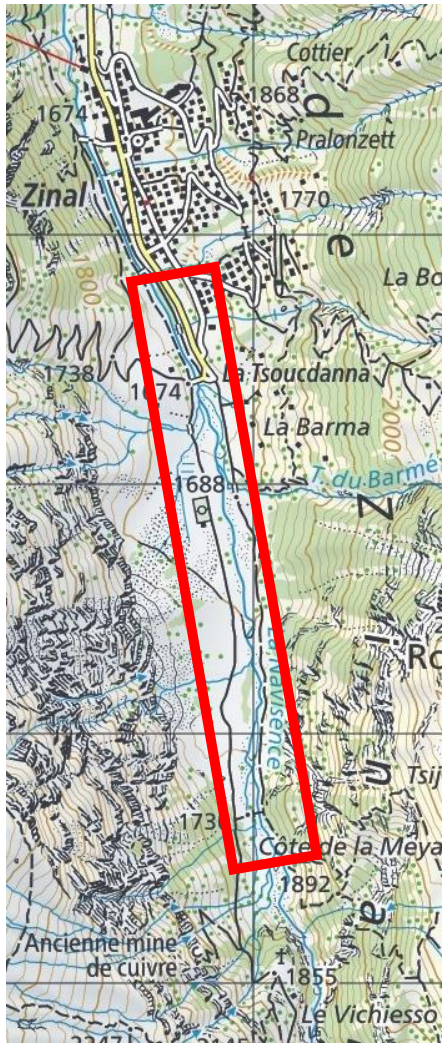
Simulation using the Swisstopo DEM (± 5 m)



Simulation using our DEM (± 5 cm)

Area of interest ≈ 12 ha
(0.4 x 0.3 km^2)

Navisence river surveying (Zinal, VS)



Area of interest ≈ 28 ha
(2.4 x 0.12 km^2)
Average altitude ≈ 1700 m

Evolution of the river bed over time
Correlation with the data collected by the monitoring station
(in collaboration with CREALP, Sion)

Summary

Summer 2018: 12 geo-referenced 3D maps of the monitored section

Average Ground Sampling Distance: 1.2 cm/pixel

- 20 GCP
- 6 flights (≈ 2 hours)
- 45 m height
- 850 images

Summary

1 major event due to a thunderstorm (July 2nd 2018)

Lost GCP

Summary

1 major event due to a thunderstorm (July 2nd 2018)

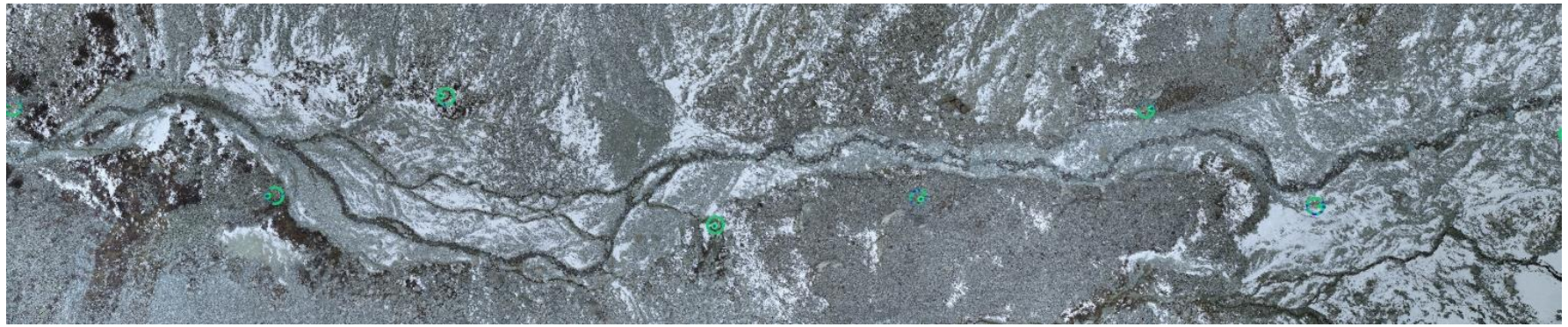
=> Look for «Navisence flood» on Youtube to see the entire section

Upper part surveying (Zinal, VS)

Area of interest ≈ 55 ha
(2 x 0.28 km^2)
Average altitude ≈ 2000 m

Example of a GCP

Summary



- 15 GCP
- 5 flights (≈ 1.4 hours)
- 90 m height
- 540 images

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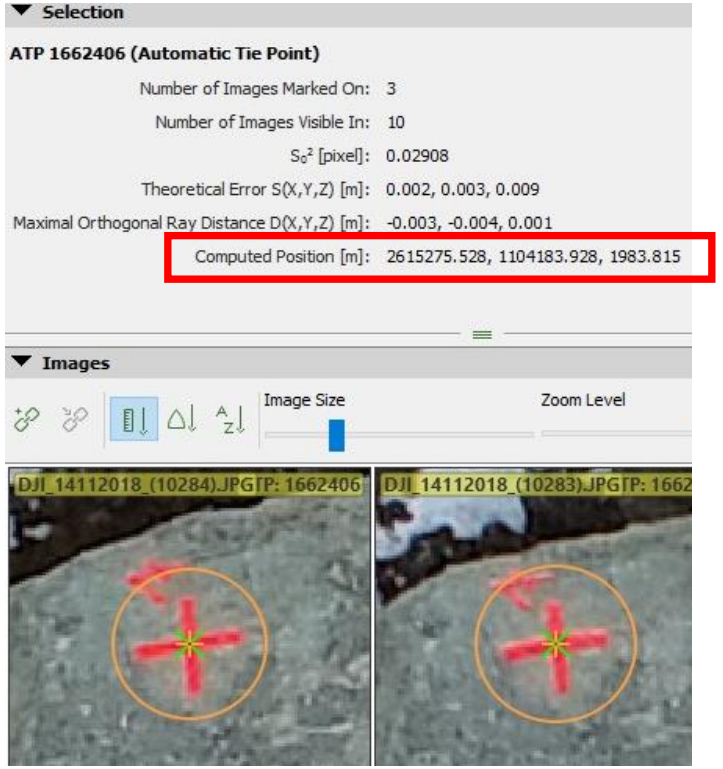
Computation with Pix4D

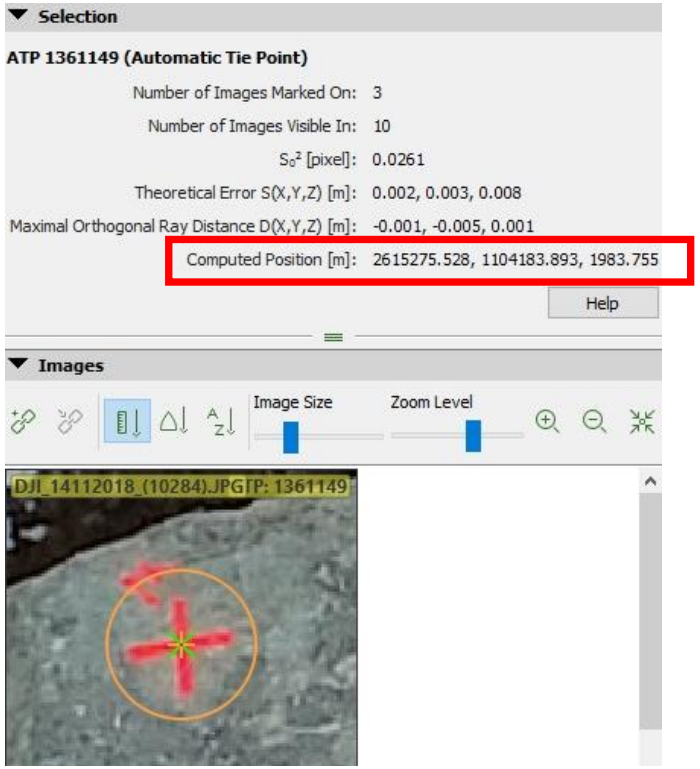
Summary

Average Ground Sampling Distance: 2.4 cm/pixel

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2} = 6.95\ cm$$



Coordinates with the GCP



Coordinates without the GCP after re-processing

Material

Flying System

DJI Phantom 4 Pro

Total weight: 1.4 kg

Autonomy: ≈ 25 minutes

Camera: integrated 20mp 8.8 mm lens (24 mm)

Price: 2400 USD

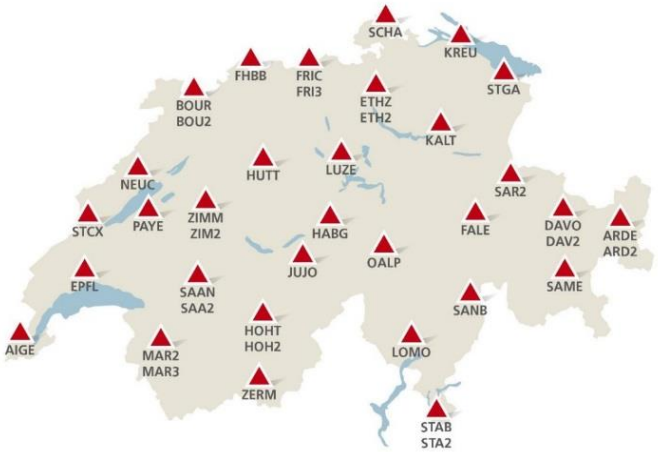
GCP positioning

Leica Zeno 20

Centimetric correction using RTK network

Lightweight and fast

Price: 12000 USD



Software

Mission planning

Pix4D Capture (free app for Android/iOS)

Set the AOI and flight !

Fast and reliable

No Terrain Awareness (constant height)

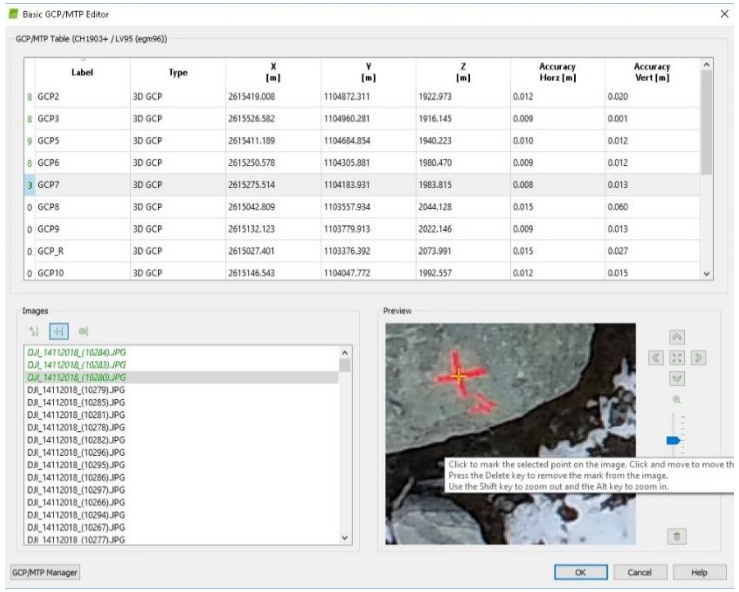
Data computation

Pix4D Desktop

Easy GCP marking / many outputs

Quality report + customer support

Educational licence: 1800 USD (+10% / year)



Future work

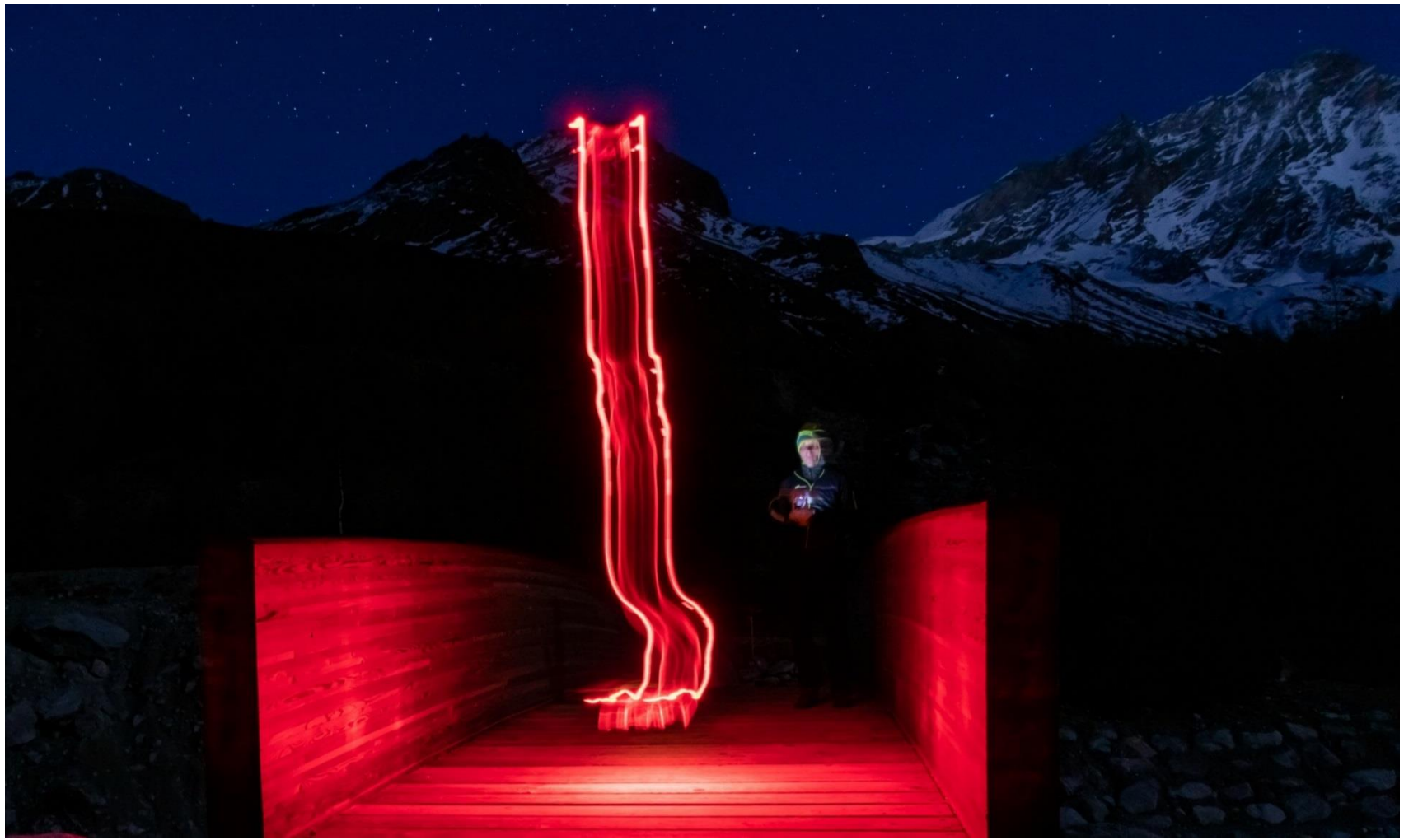
Navisence river surveying 2019 - …

- Acquire data 2 times per month on the lower section
- Acquire data 2 times per year on the upper section
- Data analysis by a master or phd student
- Install a second monitoring station

CODEV project

- Continue to share our field experience to increase our knowledge in this topic

Questions?



Pictures credits:

Bob de Graffenried

Tomas Trewhela

Ivan Pascal

Gauthier Rousseau

Claude Crausaz
(imagesenballade.blogspot.com)